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Investment and Financial Constraints in European Agriculture: Evidence from France, Hungary and Slovenia

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Abstract

The article investigates the investment and financial constraints for French, Hungarian and Slovenian farms using FADN panel data with different econometric estimation approaches. Farm gross investment is positively associated with real sales growth and cash flow implying the absence of soft budget constraint. Gross farm investment is positively associated with investment subsidies. Specific results by country are found depending on farm indebtedness. Investment subsidies can mitigate some capital market imperfections in short-term, while on long-term what is crucial is farm sale ability to successfully compete in the output market gaining sufficient cash flow for farm competitive survival and investment.

Keywords: farm investment, soft budget constraint, investment subsidy, panel data analysis

JEL classification: D81, D92, O12, Q12, C23

Beruházások és pénzügyi korlátok az európai mezőgazdaságban: Franciaország, Magyarország és Szlovénia példája

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Összefoglaló

A cikk többféle ökonometriai modell segítségével, FADN tesztüzemi panel adatbázis felhasználásával elemzi a mezőgazdasági beruházások, valamint pénzügyi korlátok jelenlétét a francia, a magyar és a szlovén gazdaságok esetében. A bruttó mezőgazdasági beruházásokat pozitívan befolyásolja a reáleladások növekedése, valamint a cash-flow, ami a puha költségvetési korlát hiányára utal. A beruházási támogatások pozitívan hatnak a bruttó beruházásokra. A mezőgazdasági üzem eladósodottságának a hatása országspecifikus. Rövid távon a beruházási támogatások enyhítik ugyan a tőkepiaci tökéletlenségek hatását, hosszú távon azonban a legfontosabb túlélést és beruházásokat biztosító tényező a sikeres piaci versenyben elért elégséges bevétel.

Tárgyszavak: mezőgazdasági beruházások, puha költségvetési korlát, beruházási támogatás, paneladat-elemzés

JEL kódok: D81, D92, O12, Q12, C23

1. INTRODUCTION

There is a wealth of literature on the presence of capital market imperfections and their effects on firm investment in transition countries (e.g. Budina et al., 2000; Konings et al., 2003; Lizal and Svejnar, 2002; Rizov, 2004), and a few papers focusing on this issue for the agricultural sector in these countries (Petrick, 2004; Latruffe, 2005; Bojnec and Latruffe, 2007; Bakucs et al., 2009; Latruffe et al., 2010). This research provided evidence for existence of capital market imperfections during transition and after accession to the European Union (EU) (Rizov et al., 2001). In addition, some studies tested the persistence of soft budget constraint in transition economies. If soft budget constraint is still persistent, it may lead to a postponed restructuring (Kornai, 2001, Kornai et al. 2003). Soft budget constraint may be more important in agriculture because government supports to the farm sector are much higher than to firms in manufacturing. Cross-country comparison of investment behaviour is limited in the agricultural economics literature (except Benjamin and Phimister, 2002). Previous empirical analyses on investment activity in agriculture are mainly based on the augmented accelerator model or Euler equations.

The aim of this paper is to analyse the existence of soft budget constraint and credit market imperfections in three different EU countries, France, Hungary and Slovenia, using the augmented accelerator model with dynamic panel estimations. The historical development and the evolution of farms in the EU vary by countries, not only between Eastern and Western Europe, but also inside both regions. Within Eastern Europe these differentials in farm size and its growth are caused by the initial conditions that are linked to the agricultural history during the previous communist system and later institutional and policy reforms, while in Western Europe they are caused by the long-term institutional and policy evolutionary factors and market conditions. During the communist system Hungarian agriculture was collectivised and the average farm size has been all the time among the largest in Europe. In Slovenia the communist collectivisation failed and small-scale farm structure has remained among the smallest in Europe. In France farm structure has developed under market conditions and policy support, in particular the Common Agricultural Policies (CAP) measures introduced after the Second World War (Piet et al., 2010). While its farms are among the largest in Western Europe, they are smaller than in Hungary. Transition from centrally-planned to market economy in Slovenia has strengthened further development of small-scale family farms, while in Hungary a bi-modal farm structure has emerged with a greater number of small-scale family farms and a smaller number of large-scale corporate farms. The proportion of small farms in Slovenian agriculture is much higher than in Hungary. Therefore, our comparative analysis includes three countries with different historical-institutional

developments and different farm structures: small-scale farms in Slovenia, medium-sized farms in France, and bi-modal small-scale and large-scale farms in Hungary.

Our analysis is based on data from the French, Hungarian and Slovenian Farm Accountancy Data Networks (FADN). Previous research has provided evidence of capital market imperfections in these countries during transition (Bojnec and Latruffe, 2007; Bakucs et al., 2009). Our paper highlights whether such imperfections persist after accession to the EU.

2. METHODOLOGY

The starting point of our empirical analysis is the standard augmented accelerator model in the following specification (Fazzari et al., 1988):

$$\frac{I_{it}}{K_{it-1}} = \alpha_i + \alpha_1 \frac{Q_{it}}{K_{it-1}} + \alpha_2 \frac{CF_{it-1}}{K_{it-1}} + \varepsilon_{it} \quad (1)$$

where subscript i denotes the i-th farm and subscript t denotes the t-th period, while ε is a stochastic element. Iit denotes gross investment of the i-th farm between periods t and t-1, which is calculated as the change in capital stock (net investment) plus depreciation in values; values in period t were deflated by the agricultural input price index for goods and services contributing to agricultural investment Kit-1 is the stock of capital, measured by all tangible assets, in the period t-1; values in the current period t are deflated by the agricultural input price index. Qit is the change in output sales value between period's t and t-1; values in period t were deflated by the harmonized indices of consumer prices. CFit-1 denotes the real cash flow of the i-th farm, defined as before tax profits plus depreciation; values in period t were deflated by the harmonized indices of consumer prices. Dependent and explanatory variables are normalised by the stock of capital in time t-1 to control for size effects.

The positive regression coefficient α2 on the cash-flow variable is generally interpreted as a sign for credit rationing, as firstly proposed by Fazzari et al. (1988). In addition, Lizal and Svejnar (2002) suggested to consider the coefficient α2 as an indication of the presence of the soft budget constraint, and proposed two interpretations for the latter: first, the weak version when the coefficient α2 is zero; firms have access to credit for investment irrespective of their profitability. Second, the strong version of the soft budget constraint, when the coefficient α2 is negative; firms with poor financial performance can access bank loans more easily.

Following Konings et al. (2003) we estimate equation (1) in first differences to control for unobserved farm level fixed effect and possible measurement error:

$$\Delta \frac{I_{it}}{K_{it-1}} = \alpha_1 \Delta \frac{Q_{it}}{K_{it-1}} + \alpha_2 \Delta \frac{CF_{it-1}}{K_{it-1}} + \Delta \varepsilon_{it} \quad (2)$$

In our econometric estimations the baseline model is the standard augmented accelerator model (equation (2)). We then extend our model specification to include investment subsidies related to capital stock as an additional explanatory variable in a separate model.

In addition to full sample estimate, we use farm characteristics to classify farms by increasing vs. decreasing real sales, and by high debt and low debt farms. Similar as Benjamin and Phimister (2002), we define high debt and low debt farms with debt-to-asset ratio greater than 0.3 and less than 0.2 respectively, to test the sensitivity of our estimation. We also imposed outlier rules by removing farms from econometric estimates if the investment capital ratio is above 99% in absolute value (Benjamin and Phimister, 2002).

In the empirical analysis we use three econometric estimators. First, we employ standard static panel models using a Hausman test to identify whether a random or a fixed effect model is appropriate. Second, we employ the generalized method of moments (GMM) estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998), also referred to as GMM-system estimator. Windmeijer (2005) proposes a finite sample correction that provides more accurate estimates of the variance of the two-step GMM estimator. As the t-tests based on these corrected standard errors are found to be more reliable, the paper estimates the coefficients using the finite sample correction. Finally, we have an unbalanced panel dataset for the five year length period between 2003 and 2007 for France and between 2004 and 2008 for Hungary and Slovenia. Thus to correct the unbalanced nature of our data, in a third model, we estimate equation (2) with a generalised version of bias corrected LSDVC estimator proposed by Bruno (2005a)[1]. The author defines a selection indicator rit such that rit =1 if (yit, xit) is observed and rit =0 otherwise. From this the dynamic selection rule s (rit, ri,t-1) is created, that selects only the observations that are usable for the dynamic model, namely those for which both current values and one-time lagged values are observable. As it is good practice to check the sensitivity of empirical results, we will present and compare the results from the fixed effects estimator, GMM estimator, and LSDVC estimator. The French sample being too large for such estimator, it is applied to a random sample of half the size of the initial size.

[1] We apply the Stata programme xtlsdvc developed by Bruno (2005b) using Blundell and Bond (1998) estimator.

3. DATA

The data analysis is based on French, Hungarian and Slovenian FADN that includes farms above two European Size Units (ESUs; one ESU is equivalent to 1,200 euros of gross margin). The time span used for analysis is 2004-2008 for Hungary and Slovenia and 2003-2007 for France. Table 1 presents descriptive statistics of the data used. Gross investment to capital is the highest for Hungarian and the lowest for Slovenian FADN farms, but of course varies by farms. The data shows disinvestments by some farms in Slovenia and France, but not in Hungary. Real sale growth to capital is the highest for French and the lowest for Slovenian FADN farms. Real cash flow to capital is the highest for Slovenian and the lowest for French FADN farms. Similarly as real sale growth to capital, also real cash flow to capital vary by farms from negative to positive values. Real investment subsidy in period t-1 to capital is on average similar for French, Hungarian or Slovenian FADN farms.

Table 1.

Descriptive statistics for the whole period 2004-2008

Variable		Obs	Mean	Std. Dev.	Min	Max
				Hungary (in euro)		
Investment to capital	$\frac{I_{it}}{K_{it-1}}$	8367	0.096	0.220	0.000	11.633
Sale growth to capital	$\frac{Q_{it}}{K_{it-1}}$	8367	0.253	0.230	-0.939	8.004
Cash flow to capital	$\frac{CF_{it-1}}{K_{it-1}}$	8367	0.014	0.275	-10.784	3.593
Investment subsidy in period *t*-1 to capital		8367	0.004	0.029	0.000	1.080
				Slovenia (in euro)		
Investment to capital	$\frac{I_{it}}{K_{it-1}}$	2237	0.049	0.097	-0.206	11.633
Sale growth to capital	$\frac{Q_{it}}{K_{it-1}}$	2237	0.096	0.180	-0.360	8.004
Cash flow to capital	$\frac{CF_{it-1}}{K_{it-1}}$	2237	0.031	0.182	-1.076	3.593
Investment subsidy in period *t*-1 to capital		2237	0.004	0.022	0.000	1.080
				France (in euro)		
Investment to capital	$\frac{I_{it}}{K_{it-1}}$	25782	0.076	0.174	-3.440	12.500
Sale growth to capital	$\frac{Q_{it}}{K_{it-1}}$	25782	0.299	0.292	-0.729	12.049
Cash flow to capital	$\frac{CF_{it-1}}{K_{it-1}}$	25782	0.131	0.246	-12.325	9.370
Investment subsidy in period *t*-1 to capital		25782	0.004	0.019	0.000	0.868

4. ECONOMETRIC RESULTS

Results of the Hausman test suggest using fixed effect models. The standard augmented accelerator model confirms a positive association between farm investment and real sale growth and cash flow variables, respectively (Table 2). Therefore, our econometric results reject the validity of the soft budget constraint for French, Hungarian and Slovenian farms. However, they reveal the presence of capital market imperfections. Farm investments are positively associated with investment subsidies in time t in France, Hungary and Slovenia, but negatively for investment subsidies in time t-1 for France and Hungary. This implies that current investment subsidies are important for investment decisions, but except for Slovenia, they are not anticipated as a factor for long-term farm investment behaviour, where a more crucial role is plaid by farm output market conditions with real sales to growth and cash inflow into the farm household.

Table 2.

Fixed effect model results for the full samples

	Standard augmented accelerator model (equation (1)) Full sample	Including investment subsidy at *t* Full sample	Including investment subsidy at *t*-1 Full sample
HUNGARY			
Sale growth $_{t,t-1}$	0.126***	0.147***	0.125***
Cash flow $_{t-1}$	0.085***	0.079***	0.081***
Investment subsidy		2.543***	-0.173**
Constant	0.056***	0.042***	0.058***
N	5911	5911	5911
R^2	0.0015	0.1134	0.0011
Hausman test (p-value)	0.0000	0.0000	0.0000
SLOVENIA			
Sale growth $_{t,t-1}$	0.314***	0.267***	0.327***
Cash flow $_{t-1}$	0.076***	0.081***	0.075***
Investment subsidy		1.450***	0.527**
Constant	0.022***	0.020***	0.019***
N	1407	1407	1407
R^2	0.1192	0.2049	0.1306
Hausman test (p-value)	0.0000	0.0000	0.0000
FRANCE			
Sale growth $_{t,t-1}$	0.191***	0.188***	0.189***
Cash flow $_{t-1}$	0.188***	0.185***	0.187***
Investment subsidy		1.633***	-0.668***
Constant	-0.009**	-0.014***	-0.005
N	16992	16992	16992
R^2	0.0157	0.0328	0.0142
Hausman test (p-value)	0.0000	0.0000	0.0000

Dependent variable: gross investmentt,t-1 to capital. All explanatory variables are divided by capital. N: number of observations. ***/**/*: statistically significant, respectively at the 1%, 5%, and 10% levels.

Following Benjamin and Phimister (2002) we impose outlier rules to exclude farms if their investment to capital ratio is above 99% in absolute value (Table 3). The results do not change substantially. The regression coefficients for real sale growth are of a positive sign and significant in all specified cases. The regression coefficients for the cash flow variable remains with the positive sign. For Slovenia, the regression coefficients are slightly lower and closer to zero. The regression coefficients for investment subsidy in the current period t are of a positive sign and significant, but the coefficients for investment subsidy in the previous period t-1 are not significant for Hungary and Slovenia, and negative and significant for France.

Table 3.

Fixed effect model results for the full samples without farms for which the investment capital ratio is above 99% in absolute value

	Standard augmented accelerator (equation (1))	Including investment subsidy at *t*	Including investment subsidy at t-1
HUNGARY			
Sale growth $_{t,t-1}$	0.101***	0.118***	0.101***
Cash flow $_{t-1}$	0.053***	0.050***	0.052***
Investment subsidy		2.381***	-0.044
Constant	0.057***	0.045***	0.058***
N	5883	5883	5883
R^2	0.0016	0.1106	0.0014
Hausman test (p-value)	0.0000	0.0000	0.0000
SLOVENIA			
Sale growth $_{t,t-1}$	0.339***	0.282***	0.337***
Cash flow $_{t-1}$	0.023*	0.030**	0.022*
Investment subsidy		1.231***	-0.292
Constant	0.018***	0.018***	0.019***
N	1403	1403	1403
R^2	0.1316	0.2221	0.1279
Hausman test (p-value)	0.0000	0.0000	0.0000
FRANCE			
Sale growth t,t-1	0.126***	0.125***	0.125***
Cash flow t-1	0.052***	0.052***	0.052***
Investment subsidy		1.260***	-0.375***
Constant	0.022***	0.018***	0.025***
N	16940	16940	16940
R2	0.0142	0.0351	0.0121
Hausman test (p-value)	0.0000	0.0000	0.0000

Dependent variable: gross investment$_{t,t-1}$ to capital. All explanatory variables are divided by capital. N: number of observations. ***/**/*: statistically significant, respectively at the 1%, 5%, and 10% levels.

Moreover, we split our FADN sample into two sub-samples depending on farm indebtedness to classify farms as high debt vs. low debt farms that can be considered to differ in their financial constraints. Similar as Benjamin and Phimister (2002) we define high debt and low debt farms with debt-to-asset ratio greater than 0.3 and less than 0.2, respectively.

The results differ by countries and by these two debt groups of farms. For France, gross farm investment is positively and significantly associated with real sale growth in the current period t for both groups of farms with high and farm with low debts (Table 4). This finding holds also for farms with low debt in Hungary and Slovenia, but the regression coefficients for these two countries are insignificant for high debt farms. While investments in low debt farms are market driven, it is less clear for high debt farms in Hungary and Slovenia.

The regression coefficients for the cash flow variables, irrespective to the model specification, are of a positive sign and significant implying an absence of soft budget constraint but a presence of capital market imperfections. In Hungary and France, the coefficient is much higher for farms with low debt than for farms with high debt, revealing that lower indebtedness constrains more investment decisions in these countries. However, the opposite is found for Slovenia. The regression coefficients for the investment subsidy variable are mixed. They are of a positive sign and significant when pertaining to investment subsidy at time t for Hungary and France as well as for Slovenia in the case of farms with low debt. On the contrary, for Hungary they are insignificant for lagged investment subsidy variable. For Slovenia, for high debt farms the regression coefficient pertaining to lagged investment subsidy variable is insignificant, while for low debt farms they are significant, but of a negative sign. The opposite holds for French FADN farms: of a negative sign and significant for farms with high debt and insignificant for farms with low debt. The regression coefficients for the lagged investment subsidy variables imply different long-term investment behaviour of farm by countries and by the degree of indebtedness of farms. While for Hungary there is less significant long-term farm investment behaviour for these two groups of farms, the Slovenian low debt farms and French high debt farms seem to be a cautious in their long-term farm investment behaviour.

Table 4.

Fixed effect model results for the sub-samples depending on farm indebtedness

	Standard augmented accelerator (equation (1)		Including investment subsidy at *t*		Including investment subsidy at *t-1*	
	Farms with high debt	Farms with low debt	Farms with high debt	Farms with low debt	Farms with high debt	Farms with low debt
HUNGARY						
Sale growth $_{t,t-1}$	0.073	0.160***	0.100**	0.172***	0.074	0.160***
Cash flow $_{t-1}$	0.097***	0.169***	0.102***	0.162***	0.102***	0.172***
Investment subsidy			2.774***	2.258***	0.181	0.085
Constant	0.101***	0.033***	0.078***	0.024***	0.100***	0.032***
N	1214	3939	1214	3939	1214	3939
R^2	0.0065	0.0085	0.0637	0.0876	0.0056	0.0090
SLOVENIA						
Sale growth $_{t,t-1}$	0.271	0.337***	0.982	0.325***	0.288	0.335***
Cash flow $_{t-1}$	1.128***	0.023*	1.091**	0.031***	1.120***	0.023*
Investment subsidy			-2.061	1.135***	0.331	-0.470**
Constant	0.041	0.018***	-0.074	0.014***	0.036	0.020***
N	20	1361	20	1361	20	1361
R^2	0.3203	0.1211	0.3734	0.2189	0.3225	0.1125
FRANCE						
Sale growth t,t-1	0.220***	0.240***	0.218***	0.238***	0.215***	0.240***
Cash flow t-1	0.062***	0.589***	0.060***	0.587***	0.0622***	0.589***
Investment subsidy			1.543***	1.634***	-1.184***	0.045
Constant	0.009*	-0.093***	0,003	-0.097	0.016***	-0.093***
N	9939	4302	9939	4302	9939	4302
R2	0.0268	0.0028	0.0573	0.0048	0.023	0.0029

Dependent variable: gross investment$_{t,t-1}$ to capital. All explanatory variables are divided by capital. N: number of observations. ***/**/*: statistically significant, respectively at the 1%, 5%, and 10% levels.

The re-estimated adapted standard augmented models by the dynamic panel data model (GMM-SYS) confirm the positive and significant association between farm gross investment and farm real sale growth (Table 5). These results clearly imply that the FADN farm investment behaviour are driven by competitive output market conditions and the farm abilities to sell output and invest in such a market environment. Moreover, except for Slovenia, farm gross investment is positively and significantly associated with cash flow, confirming for France and Hungary the absence of the soft budget constraints for the FADN farms. For Slovenia, the regression coefficients for the cash flow variable are insignificant. Finally, farm gross investment is found to be a positively and significantly associated with investment subsidies for France, Hungary and Slovenia. To sum up, these GMM-SYS results reject the

validity of the soft budget constraints for French and Hungarian FADN farms and confirm the presence of capital market imperfections in these two countries.

Table 5.

Dynamic Panel Model (GMM-SYS) results for the full sample

	Standard augmented accelerator (equation (2))	Including investment subsidy at *t*
HUNGARY		
Sale growth $_{t,t-1}$	0.233***	0.227***
Cash flow $_{t-1}$	0.529***	0.457***
Investment subsidy		2.954***
Constant	-0.027*	-0.030**
N	5911	5911
Wald test (p-value)	0.0000	0.0000
Sargan test (p-value)	0.5729	0.1741
SLOVENIA		
Sale growth $_{t,t-1}$	0.320***	0.252**
Cash flow $_{t-1}$	0.074	0.054
Investment subsidy		0.946***
Constant	0.013	0.018
N	1407	1407
Wald test (p−value)	0.0043	0.0004
Sargan test (p-value)	0.0250	0.0197
FRANCE		
Sale growth $_{t,t-1}$	0.233***	0.226***
Cash flow $_{t-1}$	0.233***	0.212***
Investment subsidy		1.772***
Constant	-0.035**	-0.035***
N	16992	16992
Wald test (p−value)	0.0000	0.0000
Sargan test (p-value)	0.3443	0.3760

Dependent variable: gross investment$_{t,t-1}$ to capital. All explanatory variables are divided by capital. N: number of observations. ***/**/*: statistically significant, respectively at the 1%, 5%, and 10% levels.

The sample selection models based on the bootstrapped standard errors estimates provide all significant regression parameters at 1% significance level except for cash flow coefficient in France (Table 6). The positive association between gross farm investment and real sale growth is confirmed in all three countries, confirming that farms based their investment decisions on market conditions. The positive association between gross farm investment and cash flow also rejects the validity of the soft budget constraints but confirms the presence of capital market imperfections in Hungary and Slovenia. No significance is found for the French sample. Finally, gross farm investment is positively associated with investment subsidies in the three countries.

Table 6.

LSDVC sample selection models results for the full sample

	Standard augmented accelerator (equation (2))	Including investment subsidy at *t*
HUNGARY		
Sale growth $_{t,t-1}$	0.154***	0.175***
Cash flow $_{t-1}$	0.228***	0.233***
Investment subsidy		2.656***
N	5883	5883
SLOVENIA		
Sale growth $_{t,t-1}$	0.314***	0.279***
Cash flow $_{t-1}$	0.063***	0.065***
Investment subsidy		1.471***
N	1407	1407
FRANCE (half sample)		
Sale growth $_{t,t-1}$	0.182***	0.174***
Cash flow $_{t-1}$	0.024	0.029
Investment subsidy		2.360***

Dependent variable: gross investment$_{t,t-1}$ to capital. All explanatory variables are divided by capital. N: number of observations. ***/**/*: statistically significant, respectively at the 1%, 5%, and 10% levels, based on bootstrapped standard errors with 500 replications.

5. CONCLUSION

We use an adapted augmented accelerator model of gross farm investment for a panel data of French, Hungarian and Slovenian FADN farms to investigate the impact of real sale growth, cash flow and investment subsidy on gross farm investment, during the period 2003-2007 for France and 2004-2008 for Hungary and Slovenia. We use different econometric estimation approaches to test the sensitivity and robustness of our econometric results.

In a spite of different nature of FADN farms in France, Hungary and Slovenia, their investment behaviour does not differentiate substantially. Farm gross investment is positively associated with real sale growth suggesting that farm investment decisions are based on market conditions in all the three countries. The association is also of a positive sign for the cash flow variable in general, implying the absence of the soft budget constraints and the presence of capital market imperfections limiting investment expenditures. As expected, some differentials are also found between farms with low and high debts, which vary between the analysed countries. Gross farm investment is positively associated with investment subsidies. Public programmes to support farm investment (investment subsidies) seem to be successful in enhancing investment in these countries in short-term, but farms investment behaviour pertaining to investment subsidies is more cautious on long-term. This implies that investment subsidies can mitigate some capital market imperfections such as interest rate volatility, but on long-term what is crucial is farm competitiveness and ability to successfully compete in the output market gaining sufficient cash flow for farm competitive survival and investment and thus also farm growth.

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